QUARTERLY SUMMARY

OF THE

IMPROVEMENTS AND DISCOVERIES

IN THE

MEDICAL SCIENCES.

ANATOMY AND PHYSIOLOGY.

1. *On the Principle of Vital Affinity, as illustrated by recent Observations in Organic Chemistry.* By Dr. Alison, Professor of the Practice of Physic in the University of Edinburgh.—The objects of this paper are, *first*, to vindicate the use of the term affinity, and assert the principle which that term is intended to express, viz., that in living bodies ordinary chemical affinities undergo a certain change or modification, either by the addition of affinities peculiar to the living state, or the suspension of some of those which act elsewhere; and, *secondly*, to attempt, from a review of facts recently ascertained, an exposition of the laws, according to which these modifications of ordinary chemical affinities take place, and a discrimination of those changes in living bodies, which may be ascribed to them.

In proof of the first of these points, the author referred particularly to the facts known as to the formation of starch, or its allied compounds, from carbonic acid and water, by an action of certain parts of living vegetables under the influence of light, whereby the carbonic acid is decomposed and oxygen evolved; maintaining that this change, essential to the condition of all organized bodies, is so distinctly at variance with the ordinary chemical relations of carbon and oxygen, and even with those which show themselves in other parts of vegetables in the living state, and in all parts in the dead state—that we are equally bound to regard it as a strictly vital phenomenon, as the contraction of a muscle on a stimulus: and that we cannot rightly apprehend either phenomenon unless we regard them as dependent on certain laws of vital action or of vitality.

On the second point, he observed, that the physiologist is concerned only with those formations and resolutions of organic compounds which take place in the interior of living bodies, and that, premising that the first introduction of every species of organized being into the world must have been by a miraculous interposition of Divine Power, beyond the limits of scientific inquiry, the objects of investigation in this department of physiology appear to be more definite, and the strictly vital affinities which now operate, from the commencement of the life of vegetables to the death and decomposition of animals, to be fewer and simpler than had generally been supposed.

I. The first kind of action which may be ascribed to vital affinity, he described as the mere selection and retention, by certain portions of a solid, of certain substances, whether elementary or compound, already existing in a fluid that is brought in contact with it, or what is called by some a chemical filtration. This power is exemplified in living vegetables, particularly in the appropriation by them of some of the earthy and saline matters which are brought to their roots, and the rejection of others; it is more strikingly seen in the development of the lower classes of animals, especially those of the radiata and mollusca, which have horny or earthy integuments; and it is certainly the chief power concerned in all those functions of animals, to which we give the names of absorption, secretion, and even nutrition.

In regard to this simplest form of vital affinity, the following points seem ascertained:—

1. That it is usually, if not always, performed in a perfect organized being, by an attractive agency of living or growing cells, which seem always to perform the double office of extracting from the nourishing fluid the material of their own growth and reproduction, and extracting also the fluid or solid matter which they are to contain, or with which they are to be incrusted.

The matters thus consolidated from a fluid in which they previously existed, by a simple process of attraction and increased aggregation, not precipitated by any chemical separation of their component parts, assume the forms peculiar to each organized body to which they are thus added, but retain that peculiarity which in organic matter exists only in fluids—that the smallest portion of them contains all the chemical ingredients which belong to the mass, and thus any crystalline arrangement is prevented.

2. That no difference of form, or of composition, can be detected in the different cells of an organized structure, to explain the difference of the matters which they thus extract; and that, in the first development of organized beings, the difference of selecting power exercised at different points of the germinal membrane, appears to be determined by no other condition than their *position*—just as different portions of nervous matter, differing only in anatomical position, exert perfectly different vital powers, or, in the state of disease, (*e. g.* of inflammation,) peculiar attractions and repulsions appear to exist, for a time, simply at particular spots of the vascular system.

The attractions by which living cells thus appropriate to themselves portions of contiguous fluid, are obviously analogous to those by which even inorganic porous substances attract different fluids with different degrees of force, and thereby produce the phenomena of endosmose and exosmose, but are broadly distinguished from them by the peculiarity of the changes thus effected, by their infinite variety, even in different parts of the same structure, and by their uniformly temporary existence.

II. The actual transformations, or new arrangements of the chemical elements which take place in living bodies, and are peculiar to them, are illustrated by the examples of the formation of starch from water and carbonic acid, oxygen escaping; and of the formation of fat from starch, carbonic acid and water escaping.

It appears to be in the *cells* of organized structures that those transformations are likewise effected; and as the action of cells in simply extracting portions of the nourishing fluid, is analogous to the physical principle of endosmose, so their action in these metamorphoses may be illustrated, but by no means explained, by comparing them to those chemical actions to which the term catalysis is applied.

Two general observations may be made on both these modifications of the power of vital affinity—*first*, that they are obviously *transferred* from the portions of matter already endowed with them, to those which, in the growth of living beings, are added to, or substituted for, those portions of matter; just as muscular fibres already existing, communicate to all the matter which is added to them by the process of nutrition, the same contractile properties which they themselves possess; *secondly*, that every portion of matter to which any such vital properties are imparted, appears to enjoy them only for a short time; losing them so rapidly that a vital process of absorption and excretion is necessary, throughout the whole existence at least of animals, to eliminate from their bodies materials which have lost these properties and reverted to the condition of dead matter.

After stating these general principles regarding vital affinities, the author made some more special remarks on the most fundamental of all the changes in organized beings which may be referred to their action, viz., the formation of starch and its allied compounds from carbonic acid and water under the influence of light, and consequent purification of the atmosphere; and he insisted chiefly on the following points:—

1. That this change is probably gradual; the carbonic acid being taken into the juices of the plant and slowly decomposed there, more or less completely, accord-

ing to circumstances, whence result not only starch, or its allied compounds, but likewise different organic acids and various oils.

2. That the formation of sugar in plants is probably to be regarded rather as a simply chemical action than as a result of vital affinities; or that it is a first product of the decomposition of starch by the agency of water and oxygen.

3. That, on the other hand, the formation of lignin, containing more carbon and less oxygen, from starch or from cellulose, and from the carbonic acid and water brought into the cells, appears to be the result of a strictly vital affinity, strongest at the period of greatest vigour of the plant.

4. That in this, as in other of the metamorphoses which take place in living beings, and which he proposes farther to examine, the carbon, thus originally fixed on the earth's surface from the atmosphere, appears to be the chief material employed by nature for the formation of all organized structures, and to be invested, for that purpose, with peculiar and transient vital affinities, while oxygen hardly appears to exert any chemical powers in living bodies, different from those which it manifests elsewhere; but is taken into the interior of all living bodies, only that it may support the excretions which are continually going on in them, and resolving organized into inorganic matter; and thus, that it gradually resumes its power over the carbon which had been temporarily separated from it for the formation of the animated part of creation.—*Proceedings of the Royal Society of Edinburgh,* 1846.

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2. *On the Nature of Tetanus caused by Strychnine.* By Prof. Hermann Meyer, of Zurich.—The tetanic convulsions, which follow the exhibition of Strychnine, are well known; as also the fact that these convulsions can be readily excited as reflex movements. The general use of strychnine in experiments on the nervous system is very much based on the knowledge of these facts, and invites to a discussion of the question as to the mode in which the tetanus originates. The following experiments were instituted for this purpose.

Exp. I. The crural nerve of a frog, suffering from convulsions induced by strychnine, was divided; these immediately ceased in the limb.

Exp. II. No convulsions took place in a limb, in which the nerve had been divided previous to the exhibition of the poison.

From these well known experiments, it follows that the originating cause of the convulsions must be sought for in the central parts of the nervous system. But the question ensues, does the tetanus originate from an affection of an individual portion of the central organ, or in an affection of every individual portion? The following experiments, also somewhat well known, tend to throw some light on the subject.

Exp. III. The brain was removed from a frog; tetanus ensued in the trunk.

Exp. IV. Brain and cerebellum removed, result as in the preceding.

Exp. V. Medulla oblongata removed; same result.

Exp. VI. Medulla oblongata divided; general tetanus ensued.

Exp. VII. The spinal marrow was removed posterior to the giving off of the nerves to the anterior extremities; result as in the preceding case.

From these experiments, it follows that the origin of the tetanus is to be sought for in some cause common to all the central organs of the nervous system. The following experiments show what this cause is.

Exp. VIII. The posterior column of the entire spinal marrow was removed from a frog by means of a fine pair of scissors. A solution of strychnine was then either exhibited by the mouth, or applied directly to the spinal cord. Convulsions occurred only in the jaws and eyes.

Exp. IX. The posterior column of that part of the cord giving off nerves to the posterior extremities was removed. Tetanus occurred only in the head and anterior extremities.

Exp. X. The same portion of cord giving off nerves to the anterior extremities, was removed. Tetanus occurred only in the head and posterior extremities.

From these experiments, the author thinks himself entitled to conclude, that the presence of the motor nerves, even though uninjured, does not suffice to produce tetanus; but that there must also be an uninterrupted connection of the sensory and motor fibres within the central part of the nervous system. The only motions,